

## 1 CLAIMS:

- 2 1. A liquid reactant metal treatment apparatus for treating materials held in containers, the  
3 apparatus including:
- 4 (a) a liquid reactant metal containment vessel;
  - 5 (b) a release chamber positioned to receive a first liquid reactant metal from the liquid  
6 reactant metal containment vessel;
  - 7 (c) a submerging arrangement for moving a container of feed material to a release  
8 location within the release chamber;
  - 9 (d) a collection area defined by an upper surface of the release chamber for collecting  
10 fluids generated from the feed material released from the container; and
  - 11 (e) a treatment arrangement for placing the fluids collected in the collection area in  
12 contact with the first liquid reactant metal or a second liquid reactant metal.
- 13
- 14 2. The apparatus of Claim 1 further including a flow inducing arrangement for inducing a  
15 flow of first liquid reactant metal in the liquid reactant metal containment vessel from an  
16 inlet opening of the release chamber to an outlet of the release chamber.
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- 18 3. The apparatus of Claim 2 wherein the submerging arrangement includes a dunker  
19 member that extends along an inclined path from a feed area within the liquid reactant  
20 metal containment vessel to the release location within the release chamber.
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- 1      4.      The apparatus of Claim 2 wherein the release chamber includes an upper inlet opening  
2                   boundary at a first elevation of the liquid reactant metal containment vessel and an  
3                   interior boundary at a second elevation above the first elevation.  
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- 5      5.      The apparatus of Claim 3 further including a crush surface within the release chamber, the  
6                   crush surface extending generally perpendicular to the longitudinal axis of the dunker  
7                   member.  
8
- 9      6.      The apparatus of Claim 1 wherein the treatment arrangement includes a fluid handling  
10                  system for removing fluid from the collection area and placing the fluid in contact with  
11                  the first liquid reactant metal or the second liquid reactant metal.  
12
- 13     7.      A liquid reactant metal treatment apparatus for treating materials held in containers, the  
14                  apparatus including:  
15                  (a)      a liquid reactant metal containment vessel;  
16                  (b)      a release chamber connected to receive a first liquid reactant metal from the liquid  
17                                  reactant metal containment vessel;  
18                  (c)      a dunker member adapted to be driven along an incline between a retracted  
19                                  position above a liquid reactant metal level of the liquid reactant metal  
20                                  containment vessel and an extended position in which a distal portion of the

1           dunker member extends to a release location adjacent to an inlet opening of the  
2           release chamber;

3           (d)   a flow inducing arrangement for inducing a flow of first liquid reactant metal from  
4           the inlet opening of the release chamber to an outlet of the release chamber.

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6       8.     The apparatus of Claim 7 wherein the release chamber includes an upper inlet opening  
7           boundary at a first elevation of the liquid reactant metal containment vessel and an  
8           interior boundary at a second elevation above the first elevation.

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10    9.     The apparatus of Claim 8 further including an elongated treatment chamber connected to  
11       the outlet of the release chamber.

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13    10.    The apparatus of Claim 9 wherein the treatment chamber is mounted within the liquid  
14       reactant metal containment vessel and further including at least one pressure relief  
15       passage positioned along the length of the treatment chamber.

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17    11.    The apparatus of Claim 7 further including a crush surface extending generally  
18       perpendicular to the longitudinal axis of the dunker member.

19  
20    12.    A method for treating containerized materials with a liquid reactant metal, the method  
21       including the steps of:

- 1 (a) moving a container of feed material to a release location below an upper surface  
2 of a first liquid reactant metal;
- 3 (b) releasing feed material from the container while the container is held at the release  
4 location;
- 5 (c) collecting a released fluid in a released chamber, the released fluid made up of  
6 fluid generated from the released feed material; and
- 7 (d) inducing a flow of liquid reactant metal through the release chamber from an inlet  
8 end of the release chamber to an outlet end of the release chamber, the flow of  
9 liquid reactant metal providing contact between the fluid collected in the release  
10 chamber and liquid reactant metal to effect a chemical reduction of compositions  
11 in the released fluid.

12

13 13. The method of Claim 12 wherein the step of collecting the released fluids in the release  
14 chamber comprises collecting the released fluids below a level of liquid reactant metal in  
15 a liquid reactant metal containment vessel.

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17 14. The method of Claim 12 wherein the step of moving the container of feed material to the  
18 release location includes extending a dunker member along an incline from a feed area  
19 outside of the release chamber to a location within the release chamber.

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- 1      15.    The method of Claim 12 further including the step of forcing released fluid to exit the  
2            release chamber into a treatment chamber.
- 3
- 4      16.    The method of Claim 15 further including the step of contacting released fluid within the  
5            treatment chamber with a flowing surface of the liquid reactant metal.
- 6
- 7      17.    The method of Claim 12 wherein the step of releasing feed material from the container  
8            while the container is held at the release location includes the step of deforming the  
9            container against a crush surface within the liquid reactant metal.
- 10
- 11     18.    The method of Claim 12 wherein the step of releasing feed material from the container  
12           includes the step of deforming the container against a crush surface within the first liquid  
13           reactant metal.
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